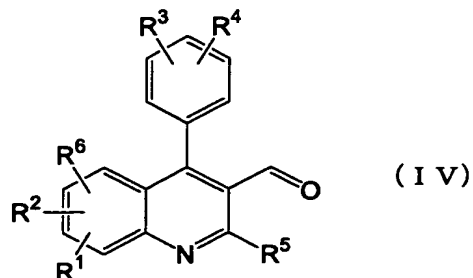
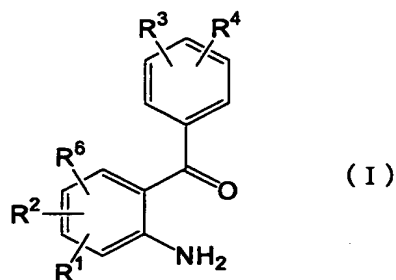


CLAIMS

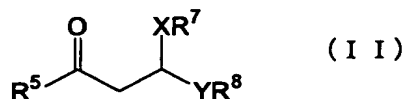
1. A production method of quinolinecarbaldehyde of the formula (IV)



wherein R^1 , R^2 , R^3 , R^4 and R^6 are each a hydrogen atom, a
 10 halogen atom, an optionally protected hydroxyl group, an
 optionally substituted alkyl group, an optionally substituted
 aryl group, an optionally substituted aralkyl group, an
 optionally substituted alkoxy group, an optionally substituted
 aryloxy group, or $R^9R^{10}N-$ wherein R^9 and R^{10} are each an
 15 optionally substituted alkyl group, R^1 and R^2 are optionally
 linked to show $-CH=CH-CH=CH-$ and R^5 is an optionally
 substituted alkyl group or an optionally substituted aryl
 group, which comprises reacting aminobenzophenone of the
 formula (I)

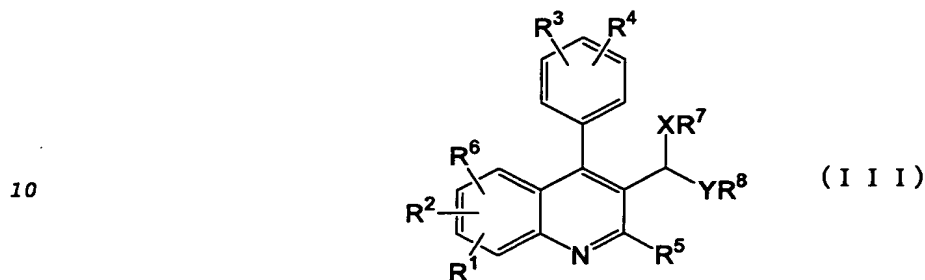


wherein R^1 , R^2 , R^3 , R^4 and R^6 are as defined above, with a β -
 ketoaldehyde derivative of the formula (II)



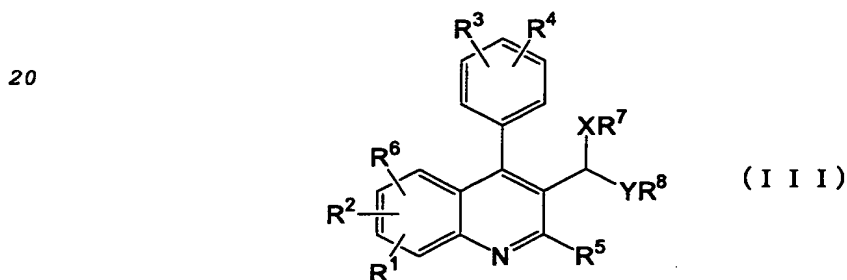
wherein R^5 is as defined above, R^7 and R^8 are each an optionally
 substituted alkyl group, an optionally substituted acyl group
 or an optionally substituted aralkyl group, or linked to show

an optionally substituted alkylene group, an optionally substituted arylene group or an aralkylene group, and X and Y are the same or different and each is an oxygen atom or a sulfur atom, in the presence of an acid to give a
 5 quinolinecarbaldehyde derivative of the formula (III)



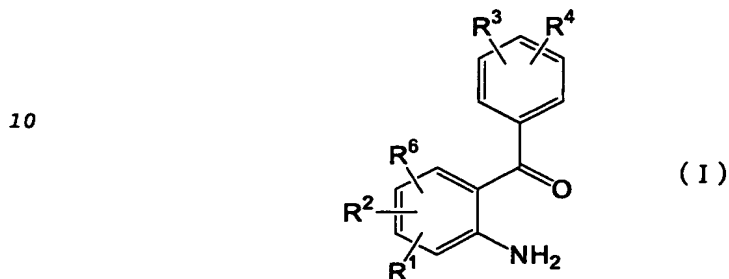
wherein R^1 , R^2 , R^3 , R^4 , R^5 , R^6 , R^7 , R^8 , X and Y are as defined above, and then hydrolyzing said quinolinecarbaldehyde
 15 derivative.

2. A production method of a quinolinecarbaldehyde derivative of the formula (III)

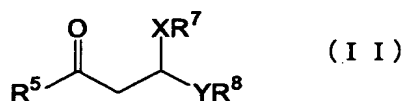


25 wherein R^1 , R^2 , R^3 , R^4 and R^6 are each a hydrogen atom, a halogen atom, an optionally protected hydroxyl group, an optionally substituted alkyl group, an optionally substituted aryl group, an optionally substituted aralkyl group, an optionally substituted alkoxy group, an optionally substituted
 30 aryloxy group, or $R^9R^{10}N-$ wherein R^9 and R^{10} are each an optionally substituted alkyl group, R^1 and R^2 are optionally linked to show $-CH=CH-CH=CH-$, R^5 is an optionally substituted alkyl group or an optionally substituted aryl group, R^7 and R^8

are each an optionally substituted alkyl group, an optionally substituted acyl group or an optionally substituted aralkyl group, or linked to show an optionally substituted alkylene group, an optionally substituted arylene group or an
 5 aralkylene group, and X and Y are the same or different and each is an oxygen atom or a sulfur atom,
 which comprises reacting aminobenzophenone of the formula (I)

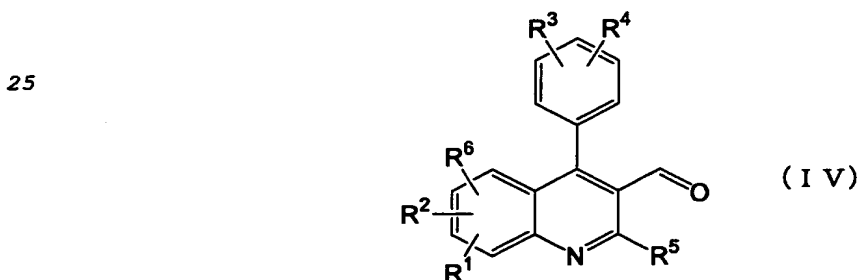


wherein R^1 , R^2 , R^3 , R^4 and R^6 are as defined above, with a β -
 15 ketoaldehyde derivative of the formula (II)



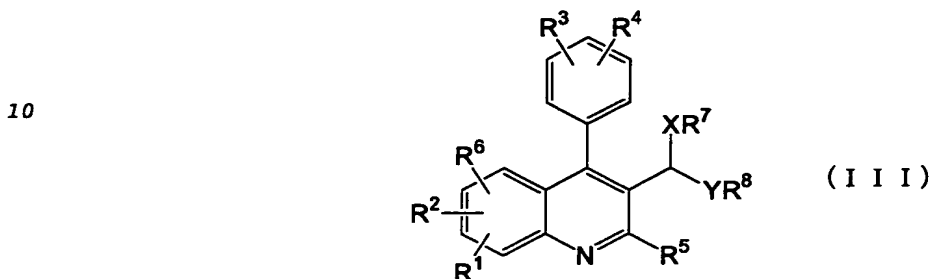
wherein R^5 , R^7 and R^8 are as defined above, in the presence of
 20 an acid.

3. A production method of quinolinecarbaldehyde of the formula
 (IV)



30 wherein R^1 , R^2 , R^3 , R^4 and R^6 are each a hydrogen atom, a halogen atom, an optionally protected hydroxyl group, an optionally substituted alkyl group, an optionally substituted aryl group, an optionally substituted aralkyl group, an

optionally substituted alkoxy group, an optionally substituted aryloxy group, or $R^9R^{10}N-$ wherein R^9 and R^{10} are each an optionally substituted alkyl group, R^1 and R^2 is optionally linked to show $-CH=CH-CH=CH-$ and R^5 is an optionally substituted alkyl group or an optionally substituted aryl group, which comprises hydrolyzing a quinolinecarbaldehyde derivative of the formula (III)



wherein R^1 , R^2 , R^3 , R^4 , R^5 and R^6 are as defined above, R^7 and R^8 are each an optionally substituted alkyl group, an optionally substituted acyl group or an optionally substituted aralkyl group, or linked to show an optionally substituted alkylene group, an optionally substituted arylene group or an aralkylene group, and X and Y are the same or different and each is an oxygen atom or a sulfur atom.

15

20

4. The production method of claim 1, wherein, in each formula, R^1 , R^2 , R^3 and R^6 are hydrogen atoms, R^4 is a halogen atom, R^5 is an alkyl group having 1 to 6 carbon atoms, R^7 and R^8 are linked to show an alkylene group, and X and Y are both oxygen atoms.

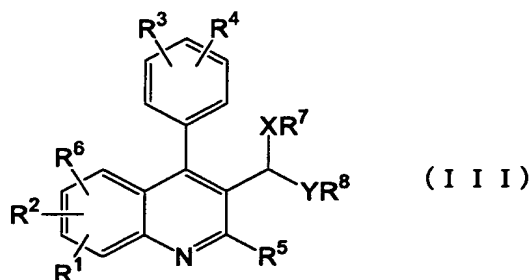
25

5. The production method of claim 4, wherein, in each formula, R^1 , R^2 , R^3 and R^6 are hydrogen atoms, R^4 is a fluorine atom, R^5 is a cyclopropyl group, R^7 and R^8 are linked to show an ethylene group, a trimethylene group, a 2-methyltrimethylene group or a 2,2-dimethyltrimethylene group, and X and Y are both oxygen atoms.

30

6. A quinolinecarbaldehyde derivative of the formula (III)

5



wherein R^1 , R^2 , R^3 , R^4 and R^6 are each a hydrogen atom, a
 10 halogen atom, an optionally protected hydroxyl group, an
 optionally substituted alkyl group, an optionally substituted
 aryl group, an optionally substituted aralkyl group, an
 optionally substituted alkoxy group, an optionally substituted
 aryloxy group, or $R^9R^{10}N-$ wherein R^9 and R^{10} are each an
 15 optionally substituted alkyl group, R^1 and R^2 are optionally
 linked to show $-CH=CH-CH=CH-$, R^5 is an optionally substituted
 alkyl group or an optionally substituted aryl group, R^7 and R^8
 are each an optionally substituted alkyl group, an optionally
 substituted acyl group or an optionally substituted aralkyl
 20 group, or linked to show an optionally substituted alkylene
 group, an optionally substituted arylene group or an
 aralkylene group, and X and Y are the same or different and
 each is an oxygen atom or a sulfur atom.

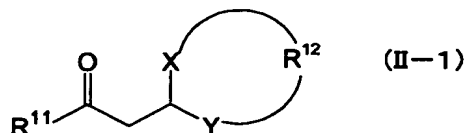
25 7. The quinolinecarbaldehyde derivative of claim 6, wherein R^1 ,
 R^2 , R^3 and R^6 are hydrogen atoms, R^4 is a halogen atom, R^5 is an
 alkyl group having 1 to 6 carbon atoms, R^7 and R^8 are linked to
 show an alkylene group, and X and Y are both oxygen atoms.

30 8. The quinolinecarbaldehyde derivative of claim 7, wherein R^1 ,
 R^2 , R^3 and R^6 are hydrogen atoms, R^4 is a fluorine atom, R^5 is a
 cyclopropyl group, R^7 and R^8 are linked to show an ethylene
 group, a trimethylene group, a 2-methyltrimethylene group or a

2,2-dimethyltrimethylene group, and X and Y are both oxygen atoms.

9. A β -ketoaldehyde derivative of the formula (II-1)

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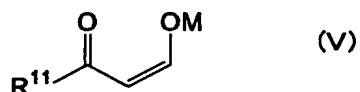
wherein R^{11} is an optionally substituted alkyl group, R^{12} is an
10 optionally substituted alkylene group, an optionally
substituted arylene group or an aralkylene group, and X and Y
are the same or different and each is an oxygen atom or a
sulfur atom.

15 10. The β -ketoaldehyde derivative of claim 9, wherein R^{12} is an
optionally substituted alkylene group having 2 to 6 carbon
atoms, and X and Y are both oxygen atoms.

11. The β -ketoaldehyde derivative of claim 10, wherein R^{11} is
20 an optionally substituted cycloalkyl group, R^{12} is an ethylene
group, a trimethylene group, a 2-methyltrimethylene group or a
2,2-dimethyltrimethylene group, and X and Y are both oxygen
atoms.

25 12. The β -ketoaldehyde derivative of claim 9, wherein R^{11} is
an optionally substituted cycloalkyl group, R^{12} is an ethylene
group, and X and Y are each an oxygen atom or a sulfur atom.

13. A production method of a β -ketoaldehyde derivative of the
30 formula (II-1), which comprises reacting a metal alkoxide
compound of the formula (V)



wherein R¹¹ is an optionally substituted alkyl group and M is
 5 an alkali metal, with a compound of the formula (VI)



wherein R¹² is an optionally substituted alkylene group, an
 optionally substituted arylene group or aralkylene group, and
 10 X and Y are the same or different and each is an oxygen atom
 or a sulfur atom, in the presence of an acid.

14. The production method of claim 13, wherein R¹¹ is an
 optionally substituted cycloalkyl group, R¹² is an alkylene
 15 group having 2 to 6 carbon atoms, and X and Y are both oxygen
 atoms.

15. The production method of claim 14, wherein R¹¹ is an
 optionally substituted cycloalkyl group, R¹² is an ethylene
 20 group, a trimethylene group, a 2-methyltrimethylene group or a
 2,2-dimethyltrimethylene group, and X and Y are both oxygen
 atoms.

16. The production method of claim 13, wherein R¹¹ is an
 25 optionally substituted cycloalkyl group, R¹² is an ethylene
 group, and X and Y are each an oxygen atom or a sulfur atom.